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Provenance and composition of Eocene-Oligocene mudrocks of the Thrace Basin (North-east Greece)

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The aim of this study is to provide new insights on Middle Eocene to Oligocene clastics of the Thrace Basin in Greece, recording synchronously phases of post-Cretaceous collision and subsequent Tertiary extension. Sedimentological and stratigraphic studies associated to the distribution of major and trace elements and the mineralogical composition of the analyzed mudrocks, are pivotal factors to reconstruct the sedimentary evolution of the Thrace Basin. The distribution of some major and trace elements (such as Fe, Mg Cr and Ni, typical of mafic source, and Al, Ti, La and Nb, typical of felsic source) for the studied samples, reflects heterogeneous source areas characterized by both felsic and mafic composition. The mineralogical composition, mainly characterized by variations in 10 Å-minerals (illite and micas), mixed-layers phases, kaolinite and chlorite amounts, coupled with the A-CN-K plot suggest a complex evolution. This may be related to (1) different source areas characterized by different conditions of weathering rates, (2) different conditions of balance between physical (tectonism/uplift/erosion) and chemical processes. The studied samples are characterized by a linear trend subparallel to A-CN join reflecting weathering from granitoid rocks, and a linear trend subparallel to A-K join and plot near the A apex reflecting the abundance of secondary clay minerals (e.g., kaolinite) over primary minerals (e.g., feldspars). The higher values of Avdira samples are anticipated because of the increased production of aluminous minerals during chemical weathering, as also showed in the mineralogical analyses. The observed trends may be result of non-steady state weathering conditions where active tectonism and uplift allow erosion of all zones within weathering profiles developed on source rocks. The occurrence of variable amount of labile minerals in studied rocks corresponds to variable degree of weathering in the source terrain. By the way, the CIA values (ranging from 56 to 77) of the studied samples generally indicate moderate chemical weathering of source rocks; only the Avdira samples (average CIA value of 86) show values may be ascribed to moderate/intense chemical weathering. The Index of Compositional Variability (ICV) values for the studied samples are >1, typical of terrigenous sedimentary rocks tend to occur in first-cycle deposits and in area characterized by tectonic uplift. The studied samples are not-affected by evident recycling processes, as showed by Al-Zr-Ti diagram, and are less mature mudrocks. All these observations support deposition in sedimentary basins close to source areas (both felsic and mafic in composition) in a tectonically active setting and reflect that relief and rate of mechanical erosion were significant.